

# Small Punch Tensile/Fracture Test Datasets on Grade 91 from cryogenic to room temperature

**F04**

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Data Sets

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## Extended Abstract

The alloy used for the tests reported here is the ferritic/martensitic steel Grade 91 (Gr. 91) (X10CrMoVNb9-1). It has the same chemical composition as P91/ T91 but is supplied in form of a plate rather than as pipe (P91) or tube (T91). The particular batch of Gr. 91 used in the present work (S50460) as part of the FP7 project MATTER [1] was originally produced for the FP6 project EUROTRANS (project domain 4: DEMETRA).

Disc shaped small punch (SP) specimens as specified in the European Code of Practice [2] were used. Their diameter was 8 mm and their thickness 0.5 mm. The surface roughness was less than  $R_a = 0.15$   $\mu\text{m}$  on both sides.

SP tensile/fracture mechanics tests were performed with varying displacement rates and temperatures as listed in Table 1. On the specimens tested at 0.5 mm/s X-ray computed tomography analysis has been carried out and the 3D surface has been reconstructed.

The metadata as well as the curve and the 3D surface data are stored in the European Commission's materials data base. Each dataset is identified through a unique digital object identifier (DOI). The data are open access and can be retrieved by following the links at the end of this document.

**Table 1** List of tests (\*for test TL10 no curve data is available because of a problem with the data acquisition)

| <b><i>Test/specimen identifier</i></b> | <b><i>Displacement rate [mm/s]</i></b> | <b><i>Temperature [°C]</i></b> | <b><i>3D data available (Y/N)</i></b> |
|--|--|--------------------------------|---------------------------------------|
| TS08                                   | 0.005                                  | -196                           | N                                     |
| TS15                                   | 0.005                                  | -196                           | N                                     |
| TS11                                   | 0.005                                  | -170                           | N                                     |
| TL08                                   | 0.005                                  | -150                           | N                                     |
| TL23                                   | 0.005                                  | -132                           | N                                     |
| TS09                                   | 0.005                                  | -120                           | N                                     |
| TL17                                   | 0.005                                  | -100                           | N                                     |
| TL22                                   | 0.005                                  | -60                            | N                                     |
| TS05                                   | 0.005                                  | -20                            | N                                     |
| TL24                                   | 0.005                                  | 23                             | N                                     |
| TL11                                   | 0.05                                   | -150                           | N                                     |
| TL14                                   | 0.5                                    | -196                           | Y                                     |
| TL10*                                  | 0.5                                    | -196                           | Y                                     |
| TL16                                   | 0.5                                    | -170                           | Y                                     |
| TS13                                   | 0.5                                    | -170                           | Y                                     |
| TL12                                   | 0.5                                    | -150                           | Y                                     |
| TL20                                   | 0.5                                    | -130                           | Y                                     |
| TS07                                   | 0.5                                    | -120                           | Y                                     |
| TL26                                   | 0.5                                    | -100                           | Y                                     |
| TL18                                   | 0.5                                    | -60                            | Y                                     |
| TS10                                   | 0.5                                    | -20                            | Y                                     |
| TL25                                   | 0.5                                    | 23                             | Y                                     |

## List of Datasets

- [1] T. Lebarbé, S. Marier, P. Agostini, C. Fazio, S. Gavrillov, Presentation of FP7 MATTER project: General overview, in: *Proceedings of the ASME 2011 Pressure Vessels & Piping Division Conference*, Baltimore, Maryland, USA, 2011.
- [2] *Small Punch Test Method for Metallic Materials*, CEN Workshop Agreement, CWA 15627:2007 E.
- [3] J.-M. Lapetite, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -196 °C and a displacement rate of 0.005 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900115> (v1.0, data set).
- [4] J.-M. Lapetite, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -196 °C and a displacement rate of 0.005 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900120> (v1.0, data set, repeat test).
- [5] J.-M. Lapetite, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -170 °C and a displacement rate of 0.005 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900118> (v1.0, data set).
- [6] J.-M. Lapetite, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -150 °C and a displacement rate of 0.005 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900100> (v1.0, data set).
- [7] J.-M. Lapetite, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -132 °C and a displacement rate of 0.005 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900109> (v1.0, data set).
- [8] J.-M. Lapetite, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -120 °C and a displacement rate of 0.005 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900116> (v1.0, data set).
- [9] J.-M. Lapetite, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -100 °C and a displacement rate of 0.005 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900105> (v1.0, data set).
- [10] J.-M. Lapetite, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -60 °C and a displacement rate of 0.005 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900108> (v1.0, data set).
- [11] J.-M. Lapetite, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -20 °C and a displacement rate of 0.005 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900113> (v1.0, data set).
- [12] J.-M. Lapetite, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at 23 °C and a displacement rate of 0.005 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900110> (v1.0, data set).
- [13] J.-M. Lapetite, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -150 °C and a displacement rate of 0.05 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900101> (v1.0, data set).
- [14] J.-M. Lapetite, S. Ripplinger, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -196 °C and a displacement rate of 0.5 mm/s*, JRC Petten, 2015. <http://dx.doi.org/10.5290/1900103> (v1.1, data set).

- [15] J.-M. Lapetite, S. Ripplinger, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -196 °C and a displacement rate of 0.5 mm/s, JRC Petten, 2015.* <http://dx.doi.org/10.5290/1900128> (v1.0, data set, repeat test).
- [16] J.-M. Lapetite, S. Ripplinger, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -170 °C and a displacement rate of 0.5 mm/s, JRC Petten, 2015.* <http://dx.doi.org/10.5290/1900104> (v1.0, data set).
- [17] J.-M. Lapetite, S. Ripplinger, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -170 °C and a displacement rate of 0.5 mm/s, JRC Petten, 2015.* <http://dx.doi.org/10.5290/1900119> (v1.0, data set, repeat test).
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- [21] J.-M. Lapetite, S. Ripplinger, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -100 °C and a displacement rate of 0.5 mm/s, JRC Petten, 2015.* <http://dx.doi.org/10.5290/1900112> (v1.0, data set).
- [22] J.-M. Lapetite, S. Ripplinger, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -60 °C and a displacement rate of 0.5 mm/s, JRC Petten, 2015.* <http://dx.doi.org/10.5290/1900106> (v1.0, data set).
- [23] J.-M. Lapetite, S. Ripplinger, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at -20 °C and a displacement rate of 0.5 mm/s, JRC Petten, 2015.* <http://dx.doi.org/10.5290/1900117> (v1.0, data set).
- [24] J.-M. Lapetite, S. Ripplinger, M. Bruchhausen, *Small punch tensile/fracture test data for Gr. 91 material (batch S50460) at 23 °C and a displacement rate of 0.5 mm/s, JRC Petten, 2015.* <http://dx.doi.org/10.5290/1900111> (v1.0, data set).